

Maternal and obstetrical factors associated with a successful trial of vaginal birth after cesarean section

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Abstract

Objective: To detect the maternal and obstetrical factors associated with successful trial of vaginal birth among women with a previous cesarean delivery.

Material and Methods: A total of 122 women who were eligible for a trial of labor after cesarean section (TOLAC) according to departmental protocol were included in this comparative prospective study. After informed consent, the women included in this study were subjected to a thorough history to detect maternal and obstetric characteristics and a standard examination to estimate fetal weight, engagement of the fetal head, intra-partum features of fetal membranes, and cervical dilatation. After delivery, data on duration of labor, labor augmentation, mode of delivery, birth outcome, and neonatal intensive care (NICU) admission were recorded and analyzed.

Results: Trial of labor after cesarean section was successful in 72.13% and was unsuccessful in 27.87%. Body mass index (BMI) was significantly lower in the successful TOLAC group compared to the unsuccessful group (23.8 ± 0.03 versus 26.2 ± 0.02 kg/m²), and the number of women with BMI >25 kg/m² was significantly high in the unsuccessful group; also, mean gestational age was significantly lower in the successful TOLAC group compared to the unsuccessful group (37.5 ± 0.04 versus 38.5 ± 0.03 weeks), and the number of women admitted in labor with gestation ≥ 40 weeks was significantly high in the unsuccessful group. The number of women admitted with >2/5 of fetal head palpable abdominally and fetal head station ≥ -2 was significantly high in the unsuccessful TOLAC group.

Conclusion: In carefully selected cases, TOLAC is safe and often successful. Presence of BMI >25 kg/m², gestation ≥ 40 weeks, and vertex station ≥ -2 were risk factors for unsuccessful TOLAC. (J Turk Ger Gynecol Assoc 2014; 15: 245-9)

Key words: Factors, successful trial, vaginal birth, cesarean section

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Introduction

Repeat cesarean deliveries are associated with pelvic adhesions, morbidly adherent placenta, bladder injury, and increased cumulative hysterectomy rates (1, 2). A World Health Organization (WHO) survey in Latin America identified that women with singleton cephalic pregnancy with prior cesarean section, despite their smaller pool, were the greatest contributors to the overall cesarean section rate (3). Successful trial of labor and vaginal birth after cesarean section (VBAC) results in decreased maternal morbidity in terms of blood transfusion, hysterectomy, and febrile morbidity as compared to repeat cesarean sections (3, 4).

Vaginal delivery after the first cesarean confirms pelvic adequacy for vaginal birth and improves the chances of subsequent vaginal deliveries, resulting in a reduction of repeat cesarean and consequent morbidities. Previous studies concluded that the success rates of vaginal birth after cesarean

section were 74% (ranging from 68%-77%) (4-6). There have been many studies conducted following a first cesarean section to examine trial of labor after cesarean section (TOLAC), irrespective of order of birth (7-11). TOLAC for a second delivery is a much-needed option in developing countries to reduce the cost and morbidities of repeat cesarean deliveries. This study was designed to detect maternal and obstetrical factors associated with a successful trial of vaginal birth among women with a previous cesarean delivery.

Material and Methods

This comparative prospective study was conducted in Ahmadi Hospital, Kuwait Oil Company (KOC), after approval of the study protocol by the institutional ethical committee. TOLAC is routinely offered at our hospital to women meeting the standard criteria for a TOLAC, according to departmental protocol. According to departmental protocol, the eligibility for TOLAC



includes women with one previous lower segment cesarean section for nonrecurrent cause (fetal distress, placenta previa, post-term pregnancy, failed induction, malpresentation, malposition), those without severe medical disorders (severe hypertension, uncontrolled diabetes, or acute liver disorder), singleton pregnancy with cephalic presentation, clinically estimated fetal weight ≤ 3.5 kg, adequate pelvis on clinical assessment and in spontaneous labor in the absence of maternal or fetal compromise (ante-partum hemorrhage, fetal distress), and those willing to undergo a trial of scar. According to departmental protocol, the decision for augmentation of labor was taken by a consulting obstetrician (Ibrahim A. Abdelazim). One hundred twenty-two women with singleton pregnancy and cephalic presentation at 37-41^{+6/7} weeks of gestation, with spontaneous onset of labor were eligible for TOLAC according to departmental protocol and were included in this study after informed consent. Women with previous upper segment cesarean, previous myomectomy, placenta previa, severe medical disorders, intrauterine growth restriction, estimated fetal weight >3.5 kg, and post-term pregnancy (≥ 42 weeks) were excluded from this study.

Trial of labor after cesarean section is defined as an attempt at vaginal delivery in women with a previous cesarean section. A successful TOLAC is defined as spontaneous or instrumental (assisted by vacuum or low forceps) delivery to a woman undergoing TOLAC. An unsuccessful TOLAC is defined as failure to achieve a vaginal birth after cesarean section in women undergoing a TOLAC and the delivery ending by emergency cesarean section.

Augmentation of labor is defined as the use of oxytocin infusion to achieve four to five uterine contractions, each lasting for 45-60 seconds, in 10 minutes.

After informed consent, the women included in this study were subjected to a thorough history to detect maternal and obstetric characteristics (age, height, weight, body mass index (BMI), gestational age, date, and indication of previous cesarean) and a standard examination to estimate fetal weight, engagement of fetal head, intra-partum features of the fetal membranes, and cervical dilatation. After the delivery, data on the duration of labor (from 4 cm dilatation until delivery), labor augmentation, mode of delivery, birth outcome, neonatal intensive care unit (NICU) admission, and APGAR score at 1 and 5 minutes of birth were recorded and statistically analyzed. For women admitted at cervical dilatation >4 cm, total duration of labor was estimated after recognizing the onset of the active phase, from the history of regular painful and increasingly intense contractions.

Sample size justification

The required sample size was calculated using G* Power software, version 3.17 for sample size calculation (*Heinrich Heine Universität; Düsseldorf; Germany), setting the α -error probability at 0.05, power (1- β error probability) at 0.95%, and effective sample size (w) at 0.3. The effective size (w) was calculated as follows $w = \sqrt{X^2/N}$, where X^2 is the chi-square test and N is the total sample size. The number of participants needed to produce a statistically acceptable figure was 111 patients, and assuming a 10% dropout rate (11 cases), 122 women were included in this prospective comparative study.

Statistical analysis

After delivery, the collected data on admission were statistically analyzed using Statistical Package for Social Sciences (SPSS; Chicago, IL, USA), version 16. Numerical variables were presented as mean and standard deviation (\pm SD), while categorical variables were presented as number and percentage. Chi-square (X^2) test was used for the comparison between groups with regard to qualitative variables, while using unpaired student t)-test was used for the comparison between groups as regards quantitative variables. Also, logistic regression analysis was done to detect maternal and obstetrical factors associated with a successful trial of vaginal birth after cesarean section. A difference with a p value <0.05 was considered statistically significant; otherwise, it was insignificant.

Results

One hundred twenty-two (122) women were eligible for TOLAC according to departmental protocol and were included in this study after informed consent. TOLAC was successful in 88 (72.13%) women (8 (9%) of them were instrumental) and was unsuccessful in 34 women (27.87%). The mean age of women included in this study was 26.7 ± 4.09 years, the mean gestational age was 38.2 ± 1.22 weeks, mean age of the last born was 2.2 ± 0.88 years, mean cervical dilatation was 4.5 ± 2.1 cm (70 (57.4%) women presented with cervical dilatation of ≥ 4 cm and 52 (42.6%) presented with cervical dilatation <4 cm), and mean duration of active labor was 6.1 ± 2.11 hours. Mean BMI was significantly lower in the successful TOLAC group compared to the unsuccessful group (23.8 ± 0.03 versus 26.2 ± 0.02 Kg/m²), mean gestational age was significantly lower in the successful TOLAC group compared to the unsuccessful group (37.5 ± 0.04 versus 38.5 ± 0.03 weeks), and duration of active labor was significantly lower in the successful TOLAC group compared to the unsuccessful group (6.4 ± 0.33 versus 8.4 ± 0.22 hours); cervical dilatation on admission was significantly higher in the successful TOLAC group compared to the unsuccessful group (5.1 ± 0.9 versus 4.0 ± 0.7 cm) (Table 1).

The number of women with BMI >25 Kg/m² was significantly higher in the unsuccessful TOLAC group compared to the successful group (20 (58.8%) versus 18 (20.5%)), and the number of women admitted in labor with gestation ≥ 40 weeks was significantly higher in the unsuccessful TOLAC group compared to the successful group (12 (35.3%) versus 8 (9.1%)); also, the number of women with inter-delivery interval <2 years was significantly higher in the unsuccessful TOLAC group compared to the successful group (24 (70.6%) versus 20 (22.7%)) (Table 2). The number of women admitted with $>2/5$ of fetal head palpable abdominally and with fetal head station ≥ -2 was significantly higher in the unsuccessful TOLAC group compared to the successful group (26 (76.5%) versus 20 (22.7%)), and the number of women admitted with cervical dilatation <4 cm was significantly higher in the unsuccessful TOLAC group compared to the successful group (24 (70.6%) versus 17 (19.3%)); also, the number of women with duration of labor ≥ 7 hours was significantly higher in the unsuccessful TOLAC group compared to the successful group (19 (55.9%) versus 15 (17.0%)) (Table 2).

Table 1. Maternal characteristics, cervical dilatation, duration of active labor, and birth outcome

Variable	Successful TOLAC (number=88) Mean±SD	Unsuccessful TOLAC (number=34) Mean±SD	p value (95% confidence interval of difference)
Age (years)	26.8±4.28	26.3±3.56	0.12** (-0.99, 1.99)
Body mass index (BMI) (kg/m ²)	23.8±0.03	26.2±0.02	0.005* (-2.41, -2.39)
Height (cm)	156.8±3.7	157.4±5.6	0.99** (-2.63, 1.43)
Weight (kg)	58.8±7.8	64.6±10.6	0.98** (-9.71, 1.89)
Gestational age (weeks)	37.5±0.04	38.5±0.03	0.03* (-1.01, -0.99)
Delivery interval (hours)	2.32±0.9	2.02±0.8	0.58** (-0.05, 0.65)
Cervical dilatation on admission (cm)	5.1±0.9	4.0±0.7	0.05* (0.7988, 1.4012)
Duration of active labor (hours)	6.4±0.33	8.4±0.22	0.005* (-2.0511, -1.8489)
Birth weight (kg)	2.9±0.3	3.0±0.4	0.99** (-0.28, 0.028)
APGAR score 1 minute	7.2±0.8	6.9±0.9	0.86** (-0.05, 0.65)
APGAR score 5 minutes	8.6±0.8	7.5±0.8	0.32** (0.79, 1.41)
*significant **non-significant TOLAC: trial of labor after cesarean section			

Table 2. Comparison between maternal and obstetrical factors in the two studied groups

Variable	Unsuccessful TOLAC Number=34 Number (%)	Successful TOLAC Number=88 Number (%)	p value Test used (X ² =Chi-square test)
Maternal Factors			
Body mass index (BMI >25 kg/m ²)	20 (58.8%)	18 (20.5%)	0.004* (<0.05)
Height <155 cm	7 (20.6%)	12 (13.6%)	0.42** (>0.05)
Gestational age on admission ≥40 weeks	12 (35.3%)	8 (9.1%)	0.03* (<0.05)
Inter-delivery interval < 2 years	24 (70.6%)	20 (22.7%)	0.001* (<0.05)
Obstetrical Factors			
Estimated fetal weight (EFW >3 -3.5 kg)	7 (20.6%)	14 (15.9%)	0.61** (>0.05)
Fetal head >2/5 palpable abdominally	26 (76.5%)	20 (22.7%)	0.001* (<0.05)
Cervical dilatation <4 cm	24 (70.6%)	17 (19.3%)	0.0004* (<0.05)
Fetal head station ≥-2	26 (76.5%)	20 (22.7%)	0.01* (<0.05)
Premature ruptured membranes	7 (20.6%)	18 (20.5%)	0.81** (>0.05)
Duration of labor ≥7 hours	19 (55.9%)	15 (17.0%)	0.002* (<0.05)
Augmentation of labor	10 (29.4%)	15 (17.0%)	0.17** (>0.05)
*significant **non-significant TOLAC: trial of labor after cesarean section			

Logistic regression analysis was done to detect the maternal and obstetrical factors associated with a successful trial of vaginal birth after cesarean section in this study and showed that estimated fetal weight ≤3.5 kg was associated with a successful TOLAC (adjusted odds ratio (AOR) 3.89 (confidence interval (CI); 0.28,

3.50), p<0.05), while presence of BMI >25 kg/m² (AOR 5.008 (CI; 1.96,12.74), p<0.05), gestation ≥40 weeks (AOR 5.45 (CI; 1.66,17.88), p<0.05), vertex station ≥-2 (AOR 3.83 (CI; 1.26,11.62), p<0.05), and cervical dilatation <4 cm (AOR 5.90 (CI; 2.17, 15.98), p<0.05) were risk factors for an unsuccessful TOLAC.

Discussion

One hundred twenty-two women eligible for a TOLAC according to departmental protocol were included in this study after informed consent. TOLAC was successful in 88 ((72.13%) women (8 (9%) of them were instrumental) and was unsuccessful in 34 women (27.87%) in this study.

Also, an 83.47% (96 women) successful vaginal birth rate after cesarean and 16.5% (19 women) failure rate were recorded in Balachandran et al. (12), while a 50% (95/190) successful vaginal birth rate after cesarean section and 50% (95/190) failure rate were recorded in Ugwu et al. (13); a 66% (344/522) successful vaginal birth rate after cesarean section was recorded by Dunwald et al. (14).

One hundred women were included in Raja and colleagues' study, and they were scored according to six variables (maternal age, gestation, indications of previous cesarean, history of vaginal birth, Bishop score, and BMI). Raja and colleagues found that the rates of successful vaginal birth after cesarean increased from 38% in women having a score of 0-3 to 58% in patients scoring 4-6. Among those having a score of 7-9 and 10-12, the success rates were 71% and 86%, respectively. Raja and colleagues concluded that increasing scores correlated with the increasing probability of vaginal birth after cesarean, and they also concluded that the admission VBAC scoring system is useful in counseling women with a previous cesarean for the option of induction of labor or repeat cesarean delivery (15).

In this study, there was no significant relation between maternal height (<155 cm) and success of TOLAC, although Sylvia Kirchengas et al. (16) reported that short stature was significantly associated with a higher incidence of operative deliveries and cesarean sections.

In this study, BMI was significantly lower in the successful TOLAC group compared to the unsuccessful group, and the number of women with BMI >25 kg/m² was significantly higher in the unsuccessful group; also, mean gestational age was significantly lower in the successful TOLAC group compared to the unsuccessful group, and the number of women admitted in labor with gestation ≥40 weeks was significantly higher in the unsuccessful group. Landon et al. (17) reported a significantly lower success rate of vaginal birth after cesarean section (68.4%) in obese (BMI ≥30) than non-obese women (76.9%), and Juhasz et al. (18) reported decreasing chances of a successful TOLAC with increasing BMI; also, Tessmer et al. (19) concluded that VBAC success was independently associated with age <30 years, body mass index <30, prior vaginal delivery, and prior VBAC.

Smith et al. (20) concluded that a TOLAC was likely to be unsuccessful at 41 weeks or 42 weeks gestation compared to a TOLAC at 40 weeks, and Coassolo et al. (21) reported a 31.3% TOLAC failure rate at 40 weeks or beyond, against 22% in <40 weeks; also, Tita et al. (22) concluded that the risks of maternal morbidities and cesarean delivery, but not neonatal morbidity, increased significantly among laboring nulliparous women beyond 39 weeks.

Cervical dilatation in the studied cases on admission was significantly higher in the successful TOLAC group compared to

the unsuccessful TOLAC group, and the number of women admitted with cervical dilatation <4 cm was significantly higher in the unsuccessful TOLAC group; also, the duration of active labor was significantly lower in the successful TOLAC group. This was similar to findings reported in the literature; also, Durnwald et al. (14) reported increased chances of a successful vaginal birth after cesarean section in women admitted with cervical dilatation of more than 1 cm.

The number of studied women with an inter-delivery interval <2 years was significantly higher in the unsuccessful TOLAC group compared to the successful group, and the number of women admitted with >2/5 of the fetal head palpable abdominally and the number of women admitted with fetal head station ≥-2 were significantly higher in the unsuccessful TOLAC group.

Logistic regression analysis was done to detect the maternal and obstetrical factors associated with a successful trial of vaginal birth after cesarean section in this study and showed that estimated fetal weight ≤3.5 kg was associated with a successful TOLAC, while the presence of BMI >25 kg/m², gestation ≥40, vertex station ≥-2, and cervical dilatation <4 cm were risk factors for an unsuccessful TOLAC.

One hundred (100) women were included in Raja and colleagues' study, and they were scored according to six variables (maternal age, gestation, indications of previous cesarean, history of vaginal birth, Bishop score, and BMI). Raja and colleagues concluded that increasing scores correlated with an increasing probability of vaginal birth after cesarean (15).

In this study, neonatal intensive care admission was significantly higher in the unsuccessful TOLAC group (2 due to birth asphyxia and 2 due to meconium aspiration and sepsis) compared to the successful group (1 case due to birth asphyxia). Ball et al. and Tan et al. reported increases in risks of neonatal morbidities and hypoxic ischemic encephalopathy (HIE) after an unsuccessful TOLAC (6, 23).

Scar dehiscence was found in 1 (0.9%) case of unsuccessful TOLAC, impending rupture was found in another case (0.9%) of unsuccessful TOLAC, and the presence of premature rupture fetal membranes and/or use of oxytocin for augmentation does not affect the success of TOLAC in this study. Also, 0.2%-0.7% risk of scar dehiscence in women undergoing TOLAC was reported in the literature and by Cahill and colleagues (4, 7). Careful decision on the use of augmentation during a TOLAC is needed, and spontaneous onset of labor in women with a previous cesarean section increases the chance of a successful TOLAC.

Smith et al. (20) concluded that women with a failed vaginal birth after a trial of scar and who delivered by emergency cesarean section are subjected to increased risk of uterine rupture and catastrophic rupture, leading to perinatal death. Hochler and colleagues reported a 0.3% risk of uterine rupture; 2 cases ended in a hysterectomy during their retrospective study to evaluate the safety of trial of labor after cesarean delivery in grand multiparous women. They concluded that neither induction nor augmentation of labor increased the risk for uterine rupture, and they also concluded that trial of labor after cesarean delivery in the first labor after a prior cesarean delivery conferred a higher risk for hysterectomy (24).

In carefully selected cases, TOLAC is safe and often successful. Estimated fetal weight ≤ 3.5 kg was associated with a successful TOLAC, while the presence of BMI >25 kg/m², gestation ≥ 40 weeks, vertex station ≥ -2 , and cervical dilatation <4 cm were risk factors for an unsuccessful TOLAC. A careful decision in the augmentation of labor during a TOLAC is needed, and spontaneous onset of labor in women with a previous cesarean section increases the chance of a successful TOLAC.

Ethics Committee Approval: Ethics committee approval was received for this study from Ahmadi Hospital.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author contributions: Concept - I.A.A.; Design - I.A.A.; Supervision - A.A.M.E.; Resource - I.A.A., M.A.F.; Materials - I.A.A., M.A.F.; Data Collection&/or Processing - A.A.M.E.; Analysis&/or Interpretation - I.A.A.; Literature Search - M.A.K., A.H.Y.; Writing - M.A.K., A.H.Y.; Critical Reviews - B.M.S.N.

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